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solplan review

the independent newsletter of energy conservation, building science & construction practice

Inside . . . .

Public concern about environmental issues is changing the way we look at the world and how we conduct business. The new realities offer new opportunities for those who become sensitive to public perceptions and adapt to them - but it must be done with conviction.

We present several items focusing on the way these concerns impact the housing industry. What the principles of environmentally sensitive "green home" should be are presented.

Building a house in Canada with no furnace or heating plant may seem reckless, but it is possible. Rob Dumont has a proposal to build such a house as a demonstration project to show the industry and the public how it can be done.

We are seeing more people that are sensitive to extremely low concentrations of dust and pollutants in the environment. We report on a study that has been completed recently that identifies the nature of the problem and what kinds of things people have to do to make their home liveable.

Other items review the No BS Centre, and what is happening in the north, report on a study of the impact of vapour barriers in walls, about a new way of providing frost protection to water lines, cost benefits of smoke alarms in housing, CHBA-TRC news, and more.

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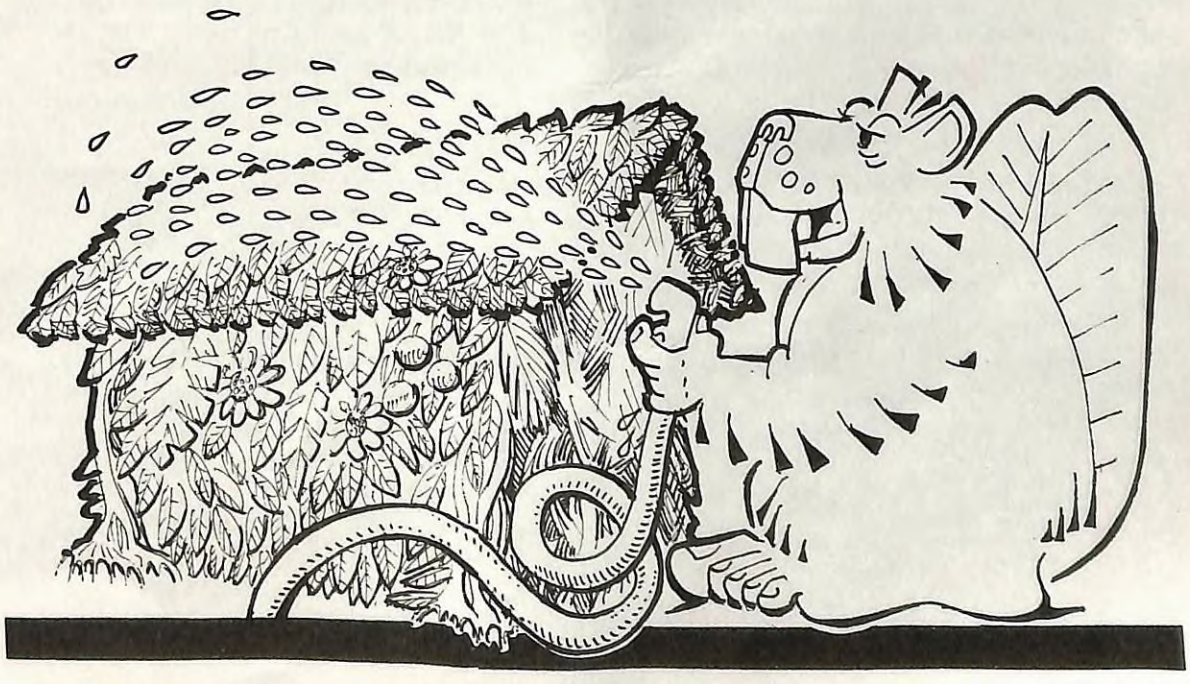

From the Publisher

The events in the Middle East once again raise concerns about security of energy supplies and energy costs. For the past few years the energy industry has been telling us about the oil glut; to forget about worrying about energy use. You could go back to the gas guzzling cars.

While marketing was not as sales oriented as it was in the late 60's, it was creeping in that direction. Ironically, the so-called glut was caused in part by the energy conservation actions that were put into place as a result of the first energy crises in the early 1970's. The fact is that fossil fuels are non-renewable and we will be running out of them at some time in the near future, so we should use then wisely.

Now the climatologists are finding that the increased use of fossil fuels is affecting the global environment. We have to take action to reduce greenhouse gasses (which are products of combustion).

What's all this have to do with housing? Housing consumes about one quarter of total energy use in Canada. Any reduction in energy use that can be made will go a long way to reduce the negative impacts of energy consumption, especially in the case of combustion of fuels which produce carbon dioxide.

I am troubled about the direction the natural gas utilities are taking with their promotions, and the message they are presenting to the public. It is especially noticeable in the Vancouver area, where the newly privatized gas utility is promoting gas sales. While they are a sponsor of the Quality Plus home program (the B.C. program that is continuing the R-2000 program), and they will tell you about higher efficiency equipment, they really want you to use more gas. They are promoting the use of gas appliances that have not been popular in the area: ranges, ovens, and dryers (but I haven't seen too many effective make-up air supply strategies). The list of useful appliances includes such essentials as patio heaters and barbecues.

If we want to be sensitive to the current public concerns about the environment (and it affects us all) then we better get serious about energy conservation in our industry. The energy performance levels of new housing should be as high as we can make them. The R-2000 standard is probably the minimum that we should aspire to. Such a product obviously can include gas appliances. It will also mean more comfortable homes with better indoor environments.

Richard Kadulski
Publisher

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The Green Home
environmentally friendly housing

Richard Kadulski

The issue of the 1990's has already been established as the environment. The catch words are environment, recylce, reduction (of waste) and global warming. We've become aware of the mess we've been making of the planet, and unless we start to clean up our act, it's going to become terribly difficult for our survival as we may be starting irreversible changes on the planet.

The problem is so large it is difficult to come to grips with it. What can any one of us do about it? It may seem too small to make a difference. But if each individual takes whatever action they can, it will have significant consequences.

We are already seeing more recycling. Blue box programs are flourishing faster than the ability of industry to actually be able to recycle waste material. But that is only the start.

Is the stress on the environment a fad? Something for big city people overwhelmed by the smog and urban pollution to worry about? I think not, but at the same time the building industry should not feel threatened. The wise builder will use this public interest to develop product that meets, or at least goes a long way in this direction. We have to remember we deal with a product that is going to be around for a long time. As we plan and build new buildings, we must consider the impact of the buildings over their life span. What is a small decision today may have very drastic consequences in the coming years.

Reducing the amount of waste generated during construction is only the start. We must look at construction with a new view point. We must look at the kind of buildings we build, the materials, the operating costs. In the absence of another term, I'll call it **the green home**.

Green Home Principles

1. It is energy independent

2. It provides a healthy environment

3. It has a low environmental impact

4. It has just enough space for comfort

5. It uses the most efficient mechanical equipment

6. It has energy efficient appliances and lighting

What are the features of an environmentally friendly green home?

It is energy independent.

Reducing energy consumption is important. This means construction with higher insulation levels and taking advantage of solar gains. It is possible to build homes in most parts of Canada that require no special heating systems. In other words they would be much more energy efficient than R-2000. (R-2000 standards should be the minimum for new homes).

It is healthy.

Products of construction should create a healthy environment. Materials should not off-gas or otherwise contribute to indoor air pollution. This may mean using more natural materials, fewer synthetics.

It must have a low environmental impact.

Materials used in construction should have little embodied energy (used in the manufacturing process) or not be the end result of toxic manufacturing processes.

There should be just enough space for comfort.

The most energy efficient mansion sprawling over thousands of square feet to house a couple with maybe one child is not efficient nor is it responsible. With proper design it is possible to provide comfortable, exciting and useable space. A compact design will use less materials and even be more affordable.

Mechanical equipment must be efficient.

Mechanical equipment is necessary to provide ventilation, a modest amount of space connditioning and hot water. The equipment should be the most efficient available.

Appliances and lighting must be energy efficient.

An important portion of energy consumption in buildings are the appliances and equipment used. Only the most efficient appliances should be used. A fridge that saves 120 kwh a month can save $50 or more per year for many years. So it makes economic sense, let alone environmental sense.

Is this all a dream? I don't think so. Many products are already available. We must simply consider how all of these go together. Builders that get involved now will be on the leading edge of environmentally friendly, healthy homes.

A Zero Energy House: Proposal for A Second Generation Low Energy House

Housing uses about one-fifth of the energy used in Canada. Since the mid 1970's, the average energy efficiency has improved considerable. Many innovations were the result of the work done and displayed for the Saskatchewan Conservation House built in 1977.

Innovations in building airtightness, heat recovery ventilation, high insulation levels, and low-mass passive solar design were all incorporated in that house. They were relatively quickly incorporated into low energy housing technology by programs such as R-2000.

Improved computer modelling tools are now available to analyze energy flows, super-windows, and high efficiency appliances. The time is now ready to build a second generation of low energy house that has no heating plant, and uses very little energy for other appliances, water heating, lights and appliances.

A passive solar house that uses super-windows and low energy building technology that needs no auxiliary space heating can be built in Canada. It would incorporate an energy efficient solar water heating system and lighting and appliances to dramatically reduce energy consumption in these areas.

The super energy efficient home must, however, be carefully designed in order to avoid overheating during warm periods.

Why should we build such a house?

A significant reduction in space heating, water heating, lights and appliance energy requirements for housing can be demonstrated.

If we are really concerned about the environment, it is important that we reduce the energy consumption at all levels of society. Over the long run the only sustainable energy sources are the renewable energy sources such as solar energy and its various derivatives (passive solar heating, photovoltaic electric power, wind power, wood energy, and hydro-electricity).

A good demonstration house will give help further the credibility of the super-window industry, which still has a low profile. It will also provide added information and data for the improvement of window technology. Performance claims for super-windows are not be matched by their actual performance. Real problems such as thermal bridging through frames, edge effects due to metal spacers, poor quality control in the low emissivity coatings application, imperfect sealing of the argon, krypton, or other inert gasses can seriously degrade the thermal performance of the windows.

What about costs?

Yes, there is a cost to improving the house but we must remember that the furnace or conventional heating systems can be eliminated in a super low energy house. A warm air furnace and heating system can save $2000 to $3000 for a typical house, money that can be applied to upgrade windows and improve the thermal envelope of the house.

Domestic Hot water systems

According to data gathered by the R-2000 program the domestic hot water system consumes about 4600 kWh/yr (assuming electricity). The most attractive sustainable energy source for this end use is solar heating. Coupled with energy saving technologies such as a passive uninsulated pre-heating tank, super-insulating the storage tank, using high efficiency pump motors (or no pump at all in a thermosyphon system), and controlling the end use by using high velocity-low flow shower heads, and aerating faucets.

Lighting and appliances

Based on R-2000 Program data, lighting and appliance energy consumption is about 8200 kWh/yr for the average household. Major energy consuming appliances include the refrigerator, freezer, stove, furnace fan (s), ventilation devices, and lighting as well as household electronics.

For most of these very energy efficient units are now available. For example, the Sun-Frost Refrigerator uses about 80% less energy than a conventional refrigerator.

A zero energy house still has to deal with a number of design issues, including providing thermal comfort in a dwelling that has a high proportion of its space heat provided by passive solar design. A major concern in a low or zero energy passive solar house is the potential problem of overheating through a good part of the year.

The Advanced House project recently completed in Brampton, Ontario goes a long way to improve house performance but it is not designed for zero space heating.

A proposal to build this type of demonstration house is being prepared by Rob Dumont at the Saskatchewan Research Council

For more information or to pursue this topic, contact:
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15 Innovation Blvd.
Saskatoon, Sask. S7N 2X8

Housing the Environmentally Sensitive

As we learn about the impact of our actions on both individual human health and the global environment, we are learning new things that have an impact on the housing industry.

We are learning that some people are affected by extremely low levels of air pollution caused by moulds, dust, pollens or chemical vapours from building materials, heating systems, paints, carpets, furniture and cleaning and maintenance products. The levels of pollution which affect these people may have no noticeable effect on healthy individuals, and may even be undetectable by them. The medical profession itself has a difficulty in identifying some cases for what they are.

Builders should be aware of the issue, as they may encounter customers with complaints about their home. The tendency when one encounters such a situation is to put down such individuals, but there could well be a legitimate reason for the complaints.

The Health Problem

The problem shows up as general health disorders. The condition is commonly described as "environmental allergy", "environmental illness", "environmental hypersensitivity", or "20th century disease".

An environmentally sensitive person reacts to one or more substances in the environment at levels which do not appear to affect the rest of the population to the same extent. It causes sufferers discomfort or in some cases severe physical reactions.

There is much debate within the medical profession both as to the legitimacy of environmental sickness and to the diagnosis and treatment administered by clinical ecologists. Several branches of clinical ecology and research medicine deal regularly with the effects of environment on health. Physicians who practice "clinical ecology" believe that there are specific components in the environment that make people ill. These can be found in food, clothing, drugs, air and water as well as in the home, work, and play environment.

What causes environmental illness?

Any number of factors can trigger reactions. The key factors are considered to be:

- Biochemical individuality: each person has a unique make-up, a product of genetics and mother's health during pregnancy.
- Total body burden: all humans are subject to biological stress, including illness, psychological stress and exposure to toxic contaminants. When the total exposure exceeds an upper limit, the body may react is a variety of ways.
- Nutritional state: nutritional health is important in the activity of the immune system.

Any combination of these factors can add up to trigger illness in a person that is sensitive. The sick person can suffer a range of effects that, unfortunately, are not easy to diagnose. Sufferers go through a prolonged period of testing and doubting until their sickness is identified.

Many who experience extreme hypersensitivity develop the condition in mid-life, though some indicated that childhood allergies had persisted, or were early warnings of a problem. Some also associated their illness with environmental exposure at work or in a neighbourhood polluted by industry or traffic. Other vulnerable individuals are young children.

There are still some important questions that have not been answered.

How Many are Affected? Is the number of environmentally ill people increasing? Is this an advance warning of a public health problem of greater proportions?

Are the people affected by environmental illness useful guides for the healthy population in terms of what can be done for prevention?

Are there useful lessons to be learned from these examples about building methods and materials which are more environmentally appropriate in terms of sustainable resource and energy use and reduced industrial pollution as well as other global concern?

Indoor Air pollutants

Indoor air pollutants that are responsible for most problems in houses are moulds, chemical pollutants, particulates, and radon.

Moulds

Fungus and mildew grows in damp places (bathrooms, basements, cold corners and closets that don't get much air circulation). Moulds release spores; mouldy smells are caused by fungi.

The smells are created complex mixes of volatile chemicals that make up the spores. Not all chemicals have been identified, nor is it clear how they actually affect people.

Chemical pollutants

There are two main groups: the inorganic gaseous pollutants and the volatile organic compounds (VOC's).

The inorganic pollutants include combustion gasses and household cleaners (e.g. chlorine (bleach), and ammonia). Smoking, unvented cooking, unvented heaters and leaking chimneys introduce combustion gases indoors. Strong exhaust fans can cause houses to operate under a negative pressure that can cause combustion appliance flue gases to spill indoors.

Volatile organic compounds comprise a wide range of chemical compounds which vary from simple to complex.

Sources are many and include building materials, furniture, carpets and synthetic floor coverings, wallpapers, plastics, household

products and bedding. Cooking, paint, new clothes and perfume odours are caused by volatile organic compounds. The most widely studied of the VOC's has been formaldehyde. Sources of formaldehyde emissions include urea-formaldehyde (UFFI) insulation, particle board and pressed board products as well as home furnishings, carpeting and many other household products, including synthetic materials.

Formaldehyde is an irritant to the eyes and respiratory system. Some studies also indicate that is a central nervous system depressant and produces numerous adverse effects.

Some VOC's are carcinogens, others affect the nervous system, or are mild intoxicants.

Particulates

House dust is made up of small particles and fibres which come from both outdoor and indoor sources. The largest of these tend to fall to the floor and collect into dust balls. Smaller particles remain airborne and easily enter the lungs.

Biological particles:
- Dust mutes
- Mould spores
- Pollens and plant fragments
- Animal dander
- Bacteria and viruses

Sawdust from softwoods such as cedar and pine are allergenic to some people due to the volatile wood resins.

Non-biological particles:
- Asbestos
- Glass fibre from insulation
- Lead from automobile emissions
- Natural and Synthetic fibres
- Dust from soils
- Combustion particles from automobiles, smokers, industry, furnaces, stoves, and fireplaces.
- Other dusts, such as plaster from construction.

Synergy

Two or more air pollutants may have a combined effect that is greater than the sum of their individual effects.

What can be done for sensitive people?

Some people who have identified health problems that are related to common air pollutants have made alterations to their homes to reduce their exposure to these agents. Some have even built new homes to rigorous clean air standards. The range of renovations undertaken includes everything from removing one or more sources of air pollution such as a carpet from the home and adding an air cleaner, to building a specially designed home with special attention paid to details suitable to their health needs.

In the winter of 1989-90 a cross-Canada survey (sponsored by CMHC) was undertaken to find out the kinds of problems people have and the kind of actions that have been taken by people with environmental health problems to reduce their exposure to indoor air pollution.

The request for participants clearly specified that the researchers wished to hear from those who not only suffered from unusual sensitivities to environmental agents, but who had also made significant changes to their homes to reduce their exposure.

Over 200 responses were received in a twelve week period of the survey from which 92 were selected for a more detailed analysis.

Figure 1 An extreme example of remedial action taken: a special fume hood to remove emmissions given off by computer, VCR and TV.

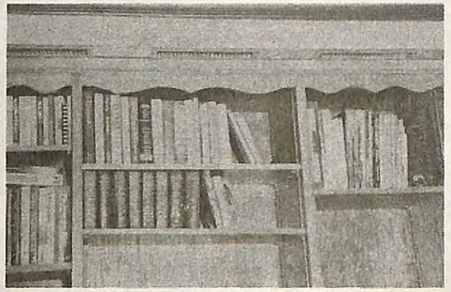


Figure 2 Even books can give off emmissions. Exhaust grilles over book case.

The study presents a partial picture of the nature and extent of "clean air" housing in Canada, what resources people have found useful in producing these houses or renovations, and the building materials and methods, heating and ventilation systems found in ten of the houses which were investigated in detail.

The work is not a definitive, statistical or academic study of the nature or scope of the environmental health problem in Canada. However, it provides a valuable resource for those who are planning, building, renovating or moving due to special environmental health concerns.

It will also help those who are interested in indoor air quality with regard to the healthy population and in building materials and systems which are more "environmentally friendly" in global terms.

What are the solutions?

There are no universal solutions. The study looked at 48 renovations, 27 new constructions and 17 moved households for a total of 92 dwellings. Because emphasis was placed on reaching those who had built new houses, the actual proportion of renovations is probably much larger represented here.

The majority of the renovations had been done in the past ten years; most of the new construction in the past 5 years or was still in progress.

Generally special measures to achieve clean indoor air are a key component. This means use of benign materials (usually natural products) or inert items like ceramics or metals. Ventilation is an important element.

The common perception that houses must be leaky to have good air quality is a myth. In most buildings, air which leaks through walls, floor, and ceilings carries with it various gases from insulation, glues, asphalt treated products and dusts contained in the cavities of the building structure.

Draft sealing methods used in energy efficient homes not only improve comfort, save energy and help prevent concealed moisture damage to the structure, but they also prevent the flushing in of pollutants from the cavities into the living space.

Energy efficient homes with ducted ventilation systems and heat recovery ventilators can be designed so that they can draw intake air from the safest point outside the home away from the streets, garages and other polluting sources. They can also provide filtration of outside air not possible with natural ventilation. Other energy efficient features such as passive solar heat retention reduce the reliance on central heat sources and consequently reduce the potential for indoor pollution from such sources.

Draft free or airtight construction ensures lower energy costs and improved longevity for buildings. Draft free construction alone does not guarantee better indoor air quality, but a well designed ventilation system in an energy efficient home can insure that fresh air is delivered to the occupied space, so long as the ducting remains clean and that exhaust is extracted from the most appropriate points. Airtight walls, ceilings and floors are highly appropriated features of the "clean air" home.

What were the health conditions of the people surveyed? The majority cited both chemical sensitivities and sensitivities to moulds, dusts, and chemical agents.

Respondents who had built new homes typically reported more severe initial sensitivities than those who renovated and, in general, the newly-constructed homes approached air quality more rigorously. The preference for all-electric or isolated combustion heating, and the preference for hardwood and ceramic floor finishes without carpets are also evident in those who built new houses.

Central ventilation systems with air filtration, custom cabinets without particle board and furnishings with chemically untreated and natural fabrics and fillings are more common in new construction than in renovations.

Floor coverings and heating systems were the first items modified in renovations. The preferred floor coverings were hardwood and ceramic tile, with small area rugs. The preferred heating systems were hot water, electric radiant heat or low temperature electric baseboard heaters. In some cases a recirculating forced air unit was used, with a low temperature fan coil heat exchanger operated by hot water or a heat pump,

CLEAN AIR HOUSING CHECKLIST

Features common in clean-air housing that were observed in the study include:

[] Heating system uses an electric source rather than petroleum fuel; a low temperature heating system is preferable.

[] Building materials with no formaldehyde or minimum emission of volatile organic compounds; woods used are not treated with wood preservatives.

[] Draft free building techniques are used to reduce the infiltration of contaminants form the outdoors or from materials in the building envelope.

[] Ventilation system to bring in fresh air and exhaust stale air from local sources of pollution within the house is used.

[] Central vacuum system which exhausts to the outside, or suitable means of removing the dust from the home.

[] Sufficient amount of natural lighting.

[] Flooring such as ceramic tiles or hardwood; tiles are laid with cement mortars rather than adhesives; concrete without admixtures, water reduction oils, and curing agents is used for foundation.

[] Wall and ceiling surfaces that do not require paints (such as plaster), or if painted, non-toxic paints are used.

[] Good outdoor ambient air quality and location away from heavy traffic, industrial pollution, or power lines is emphasized.

[] Air purification system to remove airborne contaminants such as dust, mould spores, pollens, and chemical pollutants.

[] Furniture, furnishings, household products selected for minimum emission of volatile chemical contaminants.

This is not a definitive list of steps to take, but it gives a general indication of the type of action to take. Much depends on the needs of the individual.

which also provides air filtration.

The second priority, in most cases, was the use of low emission building and finishing materials and furnishings. The most common materials avoided were particle board, interior plywood, carpets, soft plastics and plastic foams. Several respondents avoided conventional paints, varnishes and glues and a few avoided gypsum wallboard. Many substituted solid wood, cotton and wool fabrics, and special low emission paints for more conventional materials. A few built largely with masonry, concrete and plaster to avoid woods, manufactured woods and gypsum wallboard.

Though some used heat recovery ventilators ducted to all rooms, the most common ventilation systems relied on conventional local exhaust fans in bathrooms and kitchens with building leakage and open windows providing the makeup air. Some also added exhaust fans directly to laundry rooms, storage rooms and closets to remove moisture and odours from those spaces.

Many try using portable air cleaners (with charcoal adsorption) to improve air quality in unmodified homes but some report disappointing results with portable air cleaners.

Most avoid using commercial cleaners, bleaches, waxes, polishes, etc. and substituted borax, baking soda, washing soda, vinegar and mild soap flakes for cleaning purposes.

This item summarizes: Housing for the Environmentally Hypersensitive prepared for CMHC by Drerup Construction Ltd (authors: Oliver Drerup, Chris Mattock, David Rousseau, Virginia Salares, Bruce Small, Dr. Stephen Barron). Copies available from CMHC, 682 Montreal Rd, Ottawa Ont. K1A 0P7 (Tel 613-748-2367)

SUPPLIERS OF SPECIALTY PRODUCTS

This is a partial list of suppliers of products that may be suitable for low-tox housing

AIR PURIFICATION

Tibbits Ltd.
Cobourg, Ont.

Aircare/Enviroscience,
Vancouver B.C. (604) 734-4211

Sunnyhill Research Centre
Goodwood, Ont. (416) 649-1356

FABRICS & BEDDING

Island Shepherd International Inc.
Hillsborough, PEI (800) 565-0264 (in Canada)

PAINTS

Teekah, Inc.
Toronto, Ont. (416) 229-4199

Natural Structures & Supplies Inc.
Apohaqui, NB (506) 433-3455

Smiths Pharmacy
Toronto, Ont. (416) 488-2600

FLOOR COVERINGS

Erv Parent Ltd.
New Westminster, BC (604) 525-4124

Phoenix Wall & Floor Products
Rexdale, Ont. (416) 745-4200

Circul-Aire
Montreal PQ (514) 336-3330

A RANGE OF PRODUCTS (filters, selaers, fabrics, etc)

Smiths Pharmacy
Toronto, ONt. (416) 488-2600

Springfield Plumbing
Kelowna, BC (604) 861-8080

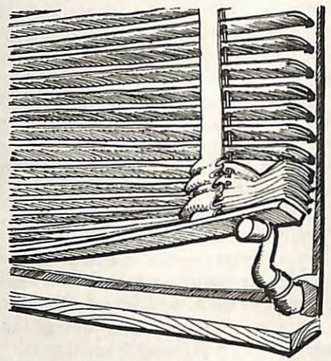
Pur et Simple
Ayer's Cliff, PQ (819) 838-4203

Allergy Relief Distributors
Richmond, BC (604) 270-0015

Allergy Resource Products Ltd.
Edmonton, AB (403) 434-3181

We'd like to see. . . .

We'd like to see window manufacturers take a bit of time to see how the end users of their product - the homeowner, deals with their products.



The beef I have is with the hardware design, especially the crank that is found on many windows. Venetian blinds are used frequently. As we've tried to illustrate, the two usually come in conflict.

The result is that homeowners remove the crank so that there is no obstruction to the blinds. This means that to open the window, the crank must be located (it never gets lost, does it?). If the window must be used in an emergency, it can't be.

There are other hardware designs where the operating mechanisms fold out of the way. Why aren't they used more frequently? Perhaps it's time to give some thought to the end user.

Builders should also think about this, and ask for alternate hardware when ordering windows. Homeowners are your customers too!

Make sure the window people get the message!♦

Vapour Barriers: how important are they?

Moisture is a major concern in construction. New building practices and materials have changed the dynamics of a building so poor details or errors will lead to problems with serious consequences.

Many still have a concern about tight construction, thinking that it will bottle up moisture and lead to early deterioration. If we remember that a house is a total system and the house is built properly, that will not be a problem.

To better understand potential problems of high moisture levels in wood frame walls, a study was started at the Prairie Regional Station of the Institute for Research in Construction in Saskatoon.

Six different wall sections and three floor sections were built, and testing started in December 1989. The intent is to monitor the sections for 2 years.

The insulation levels in the walls are high (nominal value of R22 to R43):

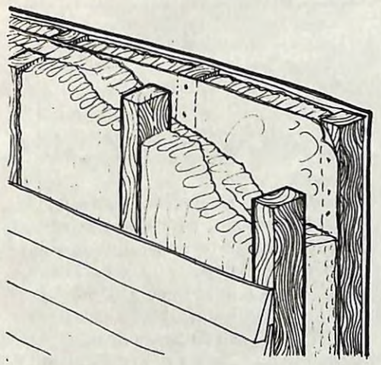


Figure 1

1. Double stud wall with a polyethylene vapour barrier approximately 1/3 of the way through the insulation. (Fig. 1)
2. Double stud wall with a polyethylene vapour barrier half way through the wall. (Fig. 2)
3. Single stud wall with vertical strapping, and sandwiched polyethylene vapour barrier about 34% of the way through the insulation.

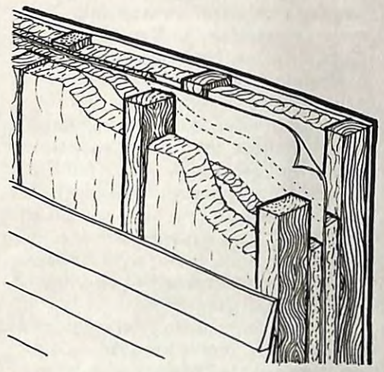


Figure 2

4. Single stud wall with horizontal strapping, and sandwiched polyethylene vapour barrier 46% of the way through the insulation.

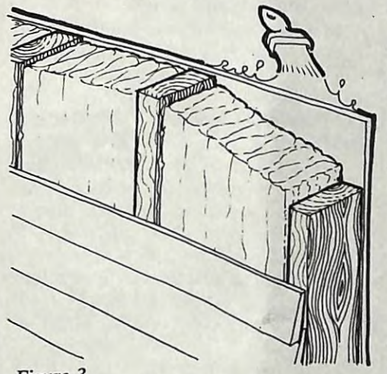


Figure 3

5. Single 2 x 8 stud with no vapour barrier, paint on gypsum board. (fig. 3)
6. Single 2 x 8 stud with poly vapour barrier

The interior relative humidity was kept at about 50% and the air temperature at 22°C. For these conditions the corresponding dew point temperature is 11°C. To keep a constant air flow through the structure from inside to outside, the pressure inside the room was set at 20 pascals.

The 50% relative humidity is higher than the measured average value for even new houses. A 1984 survey of 46 new air tight houses in Saskatoon, measured the average relative humidity at 34% (in January). While high, it is not an unreasonable value as the relative humidity values ranged from a low of 23% to a high of 49%.

Data are available for the period December 6, 1989 to May 22, 1990.

A complete analysis of data has not been done and with the closing of the Prairie Regional station of IRC the whole project may be jeopardized. The Building Science Division of the Saskatchewan Research Council is hoping to generate the funds needed to complete the work.

What has been learned so far?

Vapour barriers are important, as is their location. The 1/3 - 2/3 rule of thumb is close to the limit for acceptable positions (i.e. the vapour barrier can be up to 1/3 the way through the wall as measured by R-values, with 2/3 of the insulation value on the outside). Where the vapour barrier was in the middle, there are moisture problems.

The moisture content in the double stud wall indicated no moisture problems, as the maximum moisture content was 17% on the base plate of the inner stud wall.

The double stud wall with the vapour barrier sandwiched ½ of the way through the insulation had a moisture content above 30% for most of the monitoring period. This indicates that serious moisture accumulation was happening. 160 days after the start of the test the moisture content in the wall was still rising. It remains to be seen if significant drying will occur in the wall during the warmer summer months.

The single stud wall with vertical strapping had a moisture content with a maximum value of about 20%, and as of day 160, the moisture level was decreasing.

The single stud wall with horizontal strapping and poly vapour barrier 46% through the insulation showed a considerable moisture accumulation with a peak value of about 42%, declining to about 30% at day 160.

The single stud wall with no vapour barrier showed high moisture levels with a maximum of about 42% reached about day 150.

Single stud with polyethylene. On the warm side of the base plate the moisture content was less than 10% over the monitoring period while on the cold side the moisture content reached a high of 36%.

For details on this study:
Dr. Robert Dumont
Building Science Division
Saskatchewan Research Council
110 Gymnasium Rd
Saskatoon, Sk S7N 0W9

Gas Fireplace Alert (3)

We've reported on the problems that were discovered with direct vent gas fireplaces. Certification tests and procedures were modified and all units on sale now meet new requirements. However, **Superior Fireplaces** sent out a safety notice to owners of **GDV-5000 Direct Vent Gas Fireplaces.**

The memo says *"we must advise you to cease using this gas appliance until further notice. . . the green control knob on the gas valve should be placed in the "off" position. . . .*

Under certain conditions, it may be possible for a gas explosion to occur during the operation of the appliance. While the likelihood of this occurring is very remote, such an explosion could cause glass breakage and could expel glass fragments and the protective screen into the living space. Please note the GDV-5000 continues to meet all known applicable safety standards. . .the probability of such an explosion is unlikely. . . we strongly recommend that you do not operate the appliance until we complete our assessment of the situation."

A major Vancouver builder that got the notice is concerned because the manufacturer will not disclose any more information, nor answer any questions.♦

Freeze Protection

Keeping water supply lines from freezing is a big problem in cold climates, especially with small diameter pipes that can freeze quickly.

Freezing happens whe frost penetrates down through the soil. Standard practice is to bury the lines below the frost line. Not an easy task in northern areas with perma frost, where frost can penetrate down 10 feet or more, because of a high water table or bedrock. Common practice is to insulate the lines, to install some form of freeze protection and to bury the service at a shallow depth.

A variety of insulation techniques and/or freeze protection systems are used with varying degrees of success and expense, but no single method is completely reliable. Most commonly water is bled continuously. Despite the problems and costs involved in the continuous bleeding of water it is a fact that flowing or moving water does not freeze readily.

How big a deal is it?

In most northern communities water consumption rates peak in the winter. The national average water consumption is 420 litres per person per day. In Dawson City, Yukon it is 3890 litres, in Whitehorse it is 1680!

A recently developed system, **Aqua-flow,** is an energy saving invention that ensures the prevention of water service line freezing. Aqua-flo is a device to control the continuous flow of water 365 days of the year and 24 hours per day. This is accomplished by a BLEED, CAPTURE and RETURN method.

A constant flow of water is maintained through a single service line. The water into is returned into the system through the same line without any loss. Water is constantly flowing, but not from the tap into the sewer systems. Rather, water is bled from its source (usually the water main) into a sealed container. When the container is full, it is pumped back to its source. This cycle is repeated over and over in a closed, sterile system. During periods of electrical or mechanical failure, flow is maintained by over-flowing from the holding tank into a drain, discharged through a one-way check valve into the drain and into the sewer main or sump at a flow rate that remains unchanged at a metered flow rate of 1 litre per minute. When the power comes back on, or the malfunction is rectified the pump resumes its normal pumping cycle.

As the water bleeds into the tank, it absorbs heat from the surrounding air. The water temperature may increase by 2° to 4°C. Warmer water, pumped back at a high velocity, melts any ice formations that may begin to form in the bleed cycle.

This patented appliance consists of an 18" x 18" x 24" opaque polyethylene tank with a 74.0 litres capacity. All monitoring devices, electric motor, pump, by-pass valve, check valve, standard tie-in adaptors and tees, etc., that come in contact with water are either polyethylene, copper or brass.

To eliminate the potential for air borne contaminants to enter the system, an activated carbon air filter is used.

Mi-Sask. Industries Ltd
510 - 50th Street East
P.O. Box 3073,
Saskatoon, Sask. S7K 3S9

Credit where it's due

In **Solplan Review** No. 33 we reported on indoor airflow patterns and temperature stratification in rooms with windows open or closed ("Is the window open or closed?"). This was a report on work done by Dr. Koos Van der Maas of the Ecole Polytechnique Federale de Lausanne in Switzerland. It origianlly appeared in **'flow flash'** a newsletter of Annex 20, a special task group of the International Energy Agency that is focusing on Air Flow Patterns in Buildings.

Unfortunately, we omitted to give credit to the item. Our apologies to Dr Koos Van der Maas.♦

No BS Centre

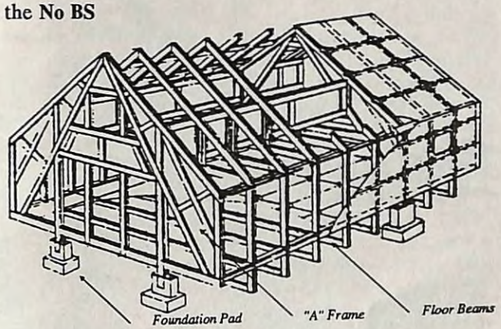
Wayne Sippola, YHBA executive officer and driving force behind the No BS Centre at the official opening ceremonies

Last issue we reported on the opening of the Northern Building Science Centre (No BS Centre). It is meant to be the focal point for northern building research and educational initiatives. These will assist to improve the quality of housing in the North.

The opening Sept. 22, 1990 was interesting for a number of reasons:
- it was the completion (and the start) of a project started by northerners for other northeners.
- the building is an example of cooperation between a number of agencies including the Yukon Home Builders Association, CMHC, Council of Forest Industries of B.C. (COFI), Yukon College, the Yukon Government, and the City of Whitehorse.
- the building is a prototype example of an innovative structural system.
- the opening marked the beginning of an international northern science alliance.

For information:
Northern Building Science Centre
c/o Yukon Home Builders Assoc.
Box 5229
Whitehorse, YT Y1A 4Z2

The Monocoque Building



The structure in which the **No BS Centre** is housed is a demonstration of the newly developed monocoque frame structural system developed by Colin Nicol-Smith and COFI with funding supplied by CMHC.

The monocoque frame was designed with the arctic in mind, but it may be equally suited to other areas with unstable soil conditions, in remote locations where adequate foundations are difficult to construct or in earthquake zones where unusual foundation forces may be encountered.

It is a monolithic structure not unlike that of an airplane body. The stiff structure carries loads through the exterior plywood skin into two structural "A"-frames down to four foundation bearing points.

In Whitehorse the building was placed on grade with a minimum of site preparation. At the time of the opening, one footing had already settled more than 1" lower. Because the building is stiff, even though one corner was lower it had no effect on windows or doors.

The monocoque shell is built with conventional spruce lumber using 4'x8' sheets of 3/4" plywood for the roof, side walls and main floor. Galvanized sheet steel is used to reinforce connections and a large number of nails transfer the shear stresses. The main floor is hung from the side walls which then transfer loads to the "A" frames. These frames provide torsional and lateral stability, allow openings in the front and rear walls and transfer all the loads from the monocoque shell to the footings. Stresses in the walls are large so openings are kept small in size and number although future changes and extra reinforcement may allow larger openings.

The floor span is 28' using built-up plywood web "I" sections spaced 48"c.c. A double shear tongue connection detail is carried throughout the construction to connect floors, walls and roof.

The current design limits the size and shape of the building and openings. The ground floor is virtually clear of any structural partitions. The second floor is also clear but with a reduced head room at the side walls.♦

For information contact:
Rob Duncan, Project Implementation Division, CMHC, Ottawa, ON
Tel: 613-748-2349

Northern Building Science Alliance

A letter of intent to establish the **Northern Building Science Alliance** was signed at the opening of the **No BS Centre.** This will bring together building industry and researchers from the polar regions, to exchange information and share in their experiences.

The objectives of the Alliance are:
- to improve the quality of design, construction, operation and maintenance of buildings in northern and remote communities.
- to improve the interchange between northern regions regarding research, development and educational activities

Dean Turner (left) looks on as Vladimir Melnikov (centre) and Tim Sullivan (right) sign letter of intent to create the Northern Building Science Alliance

Building technical issues.
- to explore possible joint research and educational initiatives which will enhance the quality of life for all Northeners.
- to expand membership to include representatives from all Northern regions.

The letter of intent was signed by representatives of the 3 founding organizations:

Dean Turner, President
Yukon Home Builders Association
Timothy M Sullivan, President
Alaska Craftsman Home Program, Inc
Vladimir Melnikov, Director
Siberian Branch USSR Academy of Sciences, Institute of Northern Development

regarding Northern Building Science.
- to increase skills and technical knowledge of persons involved with northern construction.
- to increase consumer and home occupant's awareness about Northern

Ventilation Equipment Effectiveness

Test rig to demonstrate change in air flow and static pressure: straight duct, with flow measuring grid at mid point of duct; attachments added to the end of the straight duct.

When chosing and installing fans, it is important to remember that any ducts, elbows, grilles, screens will add resistance to air flow, and reduce the amount of air that is actually moved. Fans must move air against a resistance that is built into the system once it is installed.

The B.C. Chapter of HRAI uses a simple demonstration in their trades courses to illustrate the change in air flow and static pressure when a straight duct is modified by the use of typical elements, such as a round soffit vent, a square combustion air grill, a ¼" mesh screen, a 4" to 3" reducer with 3" round flex duct, and 50 feet of 4" round dryer flex duct.

Three commonly used fans (all rated at 85 cfm at 0.2"W.C.) are used. How much of a reduction is there?

A simple 4" vent cap puts 0.4" static pressure on the system, which results in a flow of 30 cfm in two of the fans, and 53 cfm in the third. And this is with a stright duct run with no added elbows or flex duct!

This points out the importance of measuring the real air flows before everything is finished. A rated fan that in theory can do the required job may not do it if it's not installed properly.♦

$2000 to flush a toilet?

Colin Issac, a former Pollution Probe executive, recently reported that by the end of the decade flushing a toilet could cost a homeowner $ 2,000 a year. That's based on the typical toilet that uses 20 litres a flush. Currently it's $130 a year (based on $2 per thousand gallons used).

When we think about energy and reosurce conservation we think of insulation, super windows, and energy effiicent appliances.

Water conservation is also important, and will be more so especially in large urban areas as growth taxes the ability of the municipal infrastructure to deliver more services to new developments. This is the type of problem that supports the no-growth anti-development activists.

As water rates increase nbecause of the cost of new water and sewage systems, we will see the demand for low-flush toilet models. Some U.S. states are already making such fixtures mandatory as the Americans have a more serious water supply problem than Canada.

In fact. Kitchener-Waterloo, Ont. already requires that toilets using less than 3.5 gallons per flush be installed.

The major problem in Canada at the moment is that the Plumbing Code has to be changed to allow such low flush models.

Koehler has a toilet that flushes with only 1.5 US gallons, while the Swiss made Geberit toilet uses only 6 or 9 litres.♦

CSA F326.1 Adopted

The CSA standard for **Residential Mechanical Ventilation** has now been adopted as a CSA standard. As such, it is now in a form that will make it easy for code authorities to use it as a code reference. In a coming issue we will review the standard.♦

What are the costs and benefits of Smoke Alarms?

The use of sprinklers is being promoted by the sprinkler industry and fire departments. A strong campaign is being made for sprinklers to be mandatory. But is that the best way to improve life safety and reduce fire deaths?

Safety and fire deaths are an emotional issue. Fire departments use tragic pictures of casualties.

It is hard to put a cost on human life. A recent study sponsored by CMHC looked at the potential costs and benefits of sprinklers in new houses. The study concluded that the net cost of saving a life with sprinklers is $38 million or more. This was calculated after taking into account potential savings in property damage, injuries and fire service costs. Compared to the cost of saving lives by other means, sprinklers in houses are an extremely poor use of money.

Fire records show that newer houses are about 3½ times safer than the general housing stock. While increased safety is attributed to a variety of reasons, by far the major factor is the widespread use of single station smoke alarms. It is the remarkable effectiveness of these low cost devices that sprinklers have little opportunity to save lives, and thus make their cost of saving a life so high.

Because smoke alarms are so effective at increasing life safety, saving about 26 lives per year per million new houses, it would be cost effective to encourage their use in households not currently protected.

Current Use of Smoke Alarms

According to a 1988 survey by Statistics Canada, smoke alarms are used in about 83% of owner occupied households and in 74% of tenant occupied households. Ontario Housing Corporation experience indicates that where hard wired alarms are used, they are about 97% reliable.

Canadian Fire Data

There is no national data base in Canada to give information on the number of fires, fatalities, injuries and property losses in houses with and without smoke alarms. Most provinces do not collect such information. Only Alberta, British Columbia and Ontario have some data since 1984.

The fatality rate for houses without detectors was about 92 persons per million houses, with detectors it is about 34.4 persons per million houses (a 62% reduction in the fatality rate).

National fire statistics for 1 and 2 family houses are not available prior to 1980 but overall fire fatalities are, so it is difficult to compare the fire fatality rates before the general introduction of smoke alarms.

... by far the major factor (in increased safety) is the widespread use of smoke alarms. . . the remarkable efficacy of these devices means that sprinklers have little opportunity to save lives, and thus make their cost of saving a life so high.

The figures from the 3 provinces with data indicates that for the 1984-1988 period the annual fatality rate in houses with alarms was about 8.2 persons per million houses, while in houses without alarms, the rate was about 149 persons per million houses (about 18 times higher).

Smoke alarms do not reduce the number of fires but only the number of reported fires. Small, quickly detected fires may not even be reported.

20 to 30% of fire fatalities are considered to be unpreventable, due to the nature of the fire, its intimacy with the victim or the victim's lack of mobility, so there obviously is a limit to the maximum reduction attainable with smoke detectors or sprinklers.

Battery-operated smoke detectors offer a 55% reduction in fire fatalities in houses. Wired-in alarms reduce fatalities by about 65%.

Fire department officials say that sprinklers reduce the demands on the fire services so there should eventually be savings in service costs. However, there has been no reduction in fire service costs in the period of sharply reduced incidence of fires. In fact, there is greater per capita spending on fire services in spite of increased fire safety in houses. Some of this is accounted for by the increased role of fire services for other emergency and community support services.

No allowance should be made for reduced fire fighting services even if the remaining 18% of the houses are equipped with alarms. The net result of the reduced demand on present fire services would be an improved level of fire protection with no reduction in costs.

Most houses should have at least three smoke alarms: one each in the living area, sleeping area and basement.

In the 18% of Canadian houses still without smoke alarms, the annual fatality rate remains high at about 130 lives per million houses; this would be reduced by about 55%, saving about 70 lives per year per million houses if the houses were fitted with battery-operated alarms to today's usual standard of placement and operation.♦

From: "Cost Benefits of smoke alarms in Canadian Housing" Phase 3, a report prepared for CMHC by A.T. Hansen & R.E. Platts

Technical Research Committee News

Canadian Home Builders' Association

The main purpose of the Technical Research Committee (TRC) is to provide a unique industry-government forum to exchange information and focus attention on technology problems and opportunities as seen by the industry and its consumers.

TRC does not have a large bureaucracy, rather it provides a forum which helps those with research resources to focus their agendas. Each provincial builders association has a builder member on the committee. Others include representatives from industry associations, standards bodies, research agencies, as well as governments.

Drywall Discolouration

Drywall discolouration appeared a couple of years ago, and has caused many builders much grief. It was especially difficult as there did not appear to be any pattern to the occurrences, neither related to one geographical area or one manufacturer. As a result, there was a lot of detailed investigation into the drywall discolouration issue.

Chemical analysis of many samples determined that the cause was not biological, i.e. it was not a mould or fungus, but the presence of a heavy metal in the surface of the drywall joint samples. It has been identified from chemical analysis that the material is mercury. The source is a fungicide called *phenol mercuric acetate* which is found in some paints and drywall compounds.

It is believed that vapour pressure moves the mercury to the surface where it is deposited. Ultraviolet light reacts with the mercury to darken the material and creates a stain. Thus the issue is not one of workmanship, but of a combination of materials interacting with each other.

The fungicide was to have been removed from paints ten years ago, but no suitable replacement has been found. It appears that some manufacturers are still using it.

The occurrence of complaints of drywall discoloration has decreased recently.

Once again, this emphasizes that the house is a system that is greater than the sum of its parts.♦

Ventilation Task Group

The purpose of the task group is to review and assess the results of ventilation system research and field experience and to identify gaps in information and research.

A preliminary meeting was organized at CMHC with researchers who had done research in ventilation for CMHC. As mechanical ventilation becomes better understood, and new requirements are introduced into the codes, builders want to be sure they are practical and cost effective. This group will help the industry provide input into the issue.

Fire Sprinklers

Fire sprinklers are still of major concern to the building industry, as the drive to introduce mandatory requirements in all residential construction in continuing.

CHBA and CMHC are working on the production of a fire sprinkler kit. Part of this work will be aimed at creating a strategic plan intended to identify the 18% of housing not currently protected and to provide direction for future protection.

The contents of the fire sprinkler kit will include a Technical summary of the current research. This document will be targeted at regulators, including elected officials responsible for taking decisions. This part should be ready by the end of November.

The second part will be an update of CHBA's original position paper, which was presented to the National Sprinkler Task Force in 1989.

The third part will be an explanation of strategy for local and provincial homebuilders association to communicate this information to the appropriate local and provincial authorities, monitor developments, and influence decisions in this area.

Air Quality and PWF

There is a growing awareness of the importance of indoor air quality in homes. Some questions have been raised about the safety of pressure treated lumber. A study to look at air tightness and materials of preserved wood foundations related to indoor air quality should be ready early in the summer of 1991.

Indoor Air Quality

This past summer a major international conference on indoor air quality was held in Toronto. It was unique in that it brought together people from the construction industry as well as medical researchers (too often there is little communication between these camps).

It was noted that Europeans were ahead in the areas of health effects and occupant perceptions to the indoor environment while Canadians lead the way in actual field research and implementation. Canada now has to establish a materials emission standards and data as the next step in research. The house as a system approach does not yet appear to be recognized by anybody but Canadians.

Health and Welfare Canada has not yet set indoor air quality standards. What has been published are only "guidelines", and there is no actual direction on how to achieve these levels. It is not known with any certainty how ventilation affects these level. Reduction of pollutant source levels in the field can reduce needed ventilation levels.

It significant to note that there is an emerging consensus that ventilation was primarily driven by the need for fresh air by people. Ventilation is not the solution to control indoor pollutants, so pollutant source control must be addressed together with ventilation if we are to make real progress in the indoor air quality area.

Mid-Efficiency Gas furnaces

Work is underway to determine combustion gas spillage amounts for mid efficiency gas furnaces. Some is related to production quality control, so manufacturers will be involved. Allowable maximum pressurization levels may be developed.

New TRC Chairman

Bruce Clemmensen, a Toronto area builder is assuming the Chairmanship of the TRC. He replaces Willis Graham (Enco Developments, Langley, B.C.) who has been chairman since February 1989.

To contact the TRC:
Canadian Home Builders Association
200 Elgin St. Suite 502
Ottawa, ON K2P 1L5
Tel: (613) 230-3060

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HOT2000 Sales
CHBA
Suite 702, 200 Elgin St.
Ottawa, Ont. K2P 1L5
Tel: (613) 230-3060

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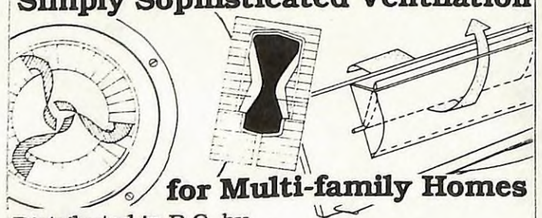
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